Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

The writer may take this opportunity of mentioning a result which lately occurred to him, respecting two *arbitrary*, but *reciprocal* conical surfaces, of which each is the locus of all the normals to the others, erected at their common vertex; namely, that two such cones have always one common conical surface of centres of curvature.

The President read the following Address:

GENTLEMEN,—We have this night reached the close of a Session of more than usual activity; and I might, therefore, naturally have desired—before leaving this Chair and adjourning the Academy to another winter—to trespass for a short time upon your attention, and to lay before you a brief summary of the results of our toil. On the present occasion, however, my duty is narrowed and defined; and the recent award of the Cunningham Medals by the Council renders it imperative on me to submit to the Academy the grounds of their decision. In doing this, it will be necessary for me to present a brief analysis of the results of those labours whose value your Council have thus honourably recognised; and in the execution of this task I must request the indulgence of the Academy, and still more that of the gentlemen of whose discoveries I am to speak, if, in my imperfect acquaintance with them, I should fail to do justice to their merits.

You are aware that, during the past Session, the laws respecting the award of medals have occupied the attention of the Council; and that certain new regulations relating to it were, upon their suggestion, adopted by the Academy. It is unnecessary for me to recapitulate these regulations, or to state the grounds for the changes therein made, as this has been already fully done by the Council, in their last Annual Report. It will be sufficient for me, on the present occasion, to remind you, that the principal alteration in the rules respecting the award of medals under the Cunningham bequest, has been to extend the limit within which the Council are enabled to bestow such rewards, and to confine them only to Memoirs or Works printed and published in Ireland, or relating to Irish subjects.

A considerable interval having elapsed since the last award of these prizes, the Council for the present year, on coming into office, referred the matter to the three Committees of which that body is composed. Upon the recommendation of these Committees, in their several departments, the Council have adjudicated Medals to the following gentlemen:

1. To Sir William Rowan Hamilton, for his "Researches respecting Quaternions," published in the twenty-first volume of the Transactions of the Academy.

2. To the Rev. Samuel Haughton, F. T. C. D., for his Memoir "On the Equilibrium and Motion of solid and fluid Bodies," published in the same volume.

3. To the Rev. Edward Hincks, D. D., for his various Papers on Egyptian and Persepolitan Writing, also published in the same volume. And

4. To John O'Donovan, Esq., for his contributions to the Transactions of the Irish Archæological Society, his Irish Grammar, and his edition of the Annals of the Four Masters.

In attempting to lay before the Academy a concise account of the origin of the new Calculus invented by Sir William Hamilton, and of the principles upon which it is based, I shall avail myself of the elucidations and applications of the theory which its gifted author has, from time to time, communicated to the Academy, and of which abstracts have appeared in our Proceedings, as also of the series of Papers published by him in the Philosophical Magazine upon the same subject. Of the latter, the author's letter to John T. Graves, Esq., written immediately after the discovery, possesses a high value, not only as a fragment of scientific history, but still more, as laying bare in a new instance that most interesting and instructive of all the mental phenomena,—the actual train of thought which takes place in the creative mind, from the first dawn of Truth within it to its full and noon-tide effulgence.

It is now twenty years since the Rev. Mr. Warren of Cambridge* showed that the ordinary imaginary symbol ($\sqrt{-1}$) had a geometrical significancy, and may denote a right line whose length is equal to unity, measured, not on the axis of the real units, but on an axis *at right angles* to it. It followed from this, and from another principle respecting the symbolical meaning of the sign +, as applied to lines, that the ordinary binomial imaginary, whose real parts, or *constituents*, are multiplied by unity and $\sqrt{-1}$, respectively, may be taken to represent both the *length* and *direction* of a right line in a given plane ; the square root of the sum of the squares of the constituents being the length of the line, and their quote, or ratio, the tangent of the angle which it forms with the axis on which the first of them is measured. These quantities have been denominated the *modulus* and the *amplitude* of the imaginary binomial.

---

* Since the delivery of this Address the attention of the writer has been directed by Sir William Hamilton to the earlier steps of the inquiry. The first appears to have been made by M. Bueé, in a Paper published in the *Philosophical Transactions* for 1806, in which he lays down the prin-

Now, if two such binomials, or *couplets*, be added together, the sum is a binomial of a similar form, or a couplet whose constituents are the *sums of the constituents* of the original couplet. And if two couplets be multiplied together, the product is likewise a couplet; and the relation of the product to the factors is such, that the modulus of the product is the *product of the moduli* of the factors, and the amplitude of the product is the *sum of the amplitudes* of the factors. From these algebraical properties of couplets, combined with their geometrical significancy, it follows that right lines in a plane, having direction as well as magnitude, may be operated upon according to certain simple algebraical conditions, and the direction and amplitude of the resultant lines obtained by certain simple algebraical rules.

It was in the effort to generalize the theory of Couplets, and to extend their properties to right lines *in space*, that Sir William Hamilton was led to the construction of his theory of Quaternions. "Since," he says, "$\sqrt{-1}$ is, in a certain well-known sense, a line

---

ciple, that the symbol $\sqrt{-1}$, as applied to lines, denoted *perpendicularity*. A further step was made by M. Argand, in a memoir published at Paris in the same year, in which he shows that the sum of two lines, estimated in direction as well as magnitude, is the diagonal of the parallelogram constructed upon them. The subject was resumed and more fully developed by M. Francais, in a memoir published in the *Annales des Mathematiques* for 1813.

perpendicular to the line 1, it seemed natural that there should be some other imaginary to express a line perpendicular to both the former; and because the rotation from 1 to this also, being doubled, conducts to -1, it also ought to be a square root of negative unity, though not to be confounded with the former."

Starting thus with the conception of *triplets* involving two distinct square-roots of negative unity, and endeavouring to frame laws for their algebraical treatment, analogous to those which hold in the case of couplets, he was soon led to perceive that the existence of the two imaginaries, just alluded to, necessarily involved the existence of a *third*, which was also a square-root of negative unity, distinct from either of the former. He was thus led to the conception of *quaternions*, or quadrinomials whose real parts, or constituents, are multiplied, the first by unity, and the other three by the three imaginary roots of negative unity just referred to; and he determined the conditions which must subsist amongst these new imaginary coefficients, in order that the resulting quadrinomials should be subject to the same algebraical laws as the ordinary imaginary binomials, or couplets.

I may here observe, in passing, that one of these laws, namely, the law of the moduli, is equivalent to a celebrated theorem of Euler; viz.: that the sum of four squares, multiplied by the sum of four squares, is also a sum of four squares. An extension of this theorem to sums of *eight* squares has been effected, independently, by Mr. John Graves and Professor Young; and the latter writer (whose paper on the subject is published in the last part of the Transactions of the Academy) has proved that the property cannot be extended to higher numbers.

To return to the Quaternion,—we have seen that it is made up of a *real* part, and an *imaginary trinomial*, using the terms *real* and *imaginary* in their ordinary acceptation. The latter of these represents a *right line in space*, drawn from the origin to the point whose co-ordinates are the three constituents of the trinomial, and it is accordingly designated by Sir William Hamilton by the term *vector*. The real part of the quaternion, on the other hand, designates *number* alone, whether positive or negative, without direction in space; and, accordingly, although real in the *algebraical* sense of the term, it is in some sense imaginary, when contemplated on the *geometrical* side. This part of the quaternion is denominated by Sir William Hamilton the *scalar.*

Thus we see that a quaternion is reducible to a binomial, the component parts of which—the scalar and the vector—designate, the one a number, the other a line. The whole tendency of the later speculations of the author has been to realize this reduction, and having determined the laws of operation upon scalars and vectors, to dismiss altogether the consideration of the constituents of the vector, and to treat it as a single integral quantity. It is easy to see what amount of simplicity is thus, at one step, introduced into the whole of Geometry and Mechanics. In place of the three co-ordinates (rectilinear or polar) by which the magnitude and direction of a *line*, or of a *force*, are ordinarily determined, the theory of Sir William Hamilton deals with the line itself, or with the force, *directly;* and thus not only is the number of necessary equations reduced at once, in the proportion of three to one, but also the interpretation of those equations is rendered simpler and more direct.

The scalar, or algebraically-real part of the quaternion, thus appearing to have no direct geometrical significancy, geometers seemed inclined to regard it as a sort of intruder in their domain; and I believe it was to the desire to exclude it, that we may, in part, attribute the very elegant and ingenious theories of *triplets,* invented by Professor De Morgan and Professor Graves. The scalar, however, is represented in mechanics by the *time;* and even in its application to pure geometry, Sir William Hamilton has shown that the introduction of this fourth quantity confers power and generality upon the calculus of quaternions, inasmuch as no direction in space is thus selected as eminent above another, but all are regarded as equally related to the *extra-spatial,* or scalar direction. The calculus thus frequently admits of a simpler and more direct application to geometrical problems than the Cartesian method of co-ordinates. inasmuch as it demands no previous selection of arbitrary axes.

I may observe, also, that in the triplet theories of Professor De Morgan and Professor Graves, the law of the moduli is not preserved, if the term modulus be taken in its ordinary signification,—

it being not generally true that the sum of *three* squares, multiplied by the sum of three squares, is a sum of three squares.

But whatever be thought of the principles of the Calculus of Quaternions, its advantages as an instrument of Mathematical Thought will undoubtedly be judged by the simplicity and ease with which it may be applied. In this the author has already done enough to establish its power. He has applied it with great success to many problems of the geometry of Surfaces ; and he has given a sketch of its application to the problem of the Three Bodies, and to the Mechanics of the Heavens generally. These instances of its application,—whether we look to the elegance and simplicity of the method, or to the beauty and symmetry of the results,—are abundantly sufficient to demonstrate the power and pliancy of the instrument.

Still, however, more will be required from its author, before the weapon which he wields with a giant's grasp may be touched by feebler hands. It will be necessary that the principles and fundamental rules of the calculus should be rendered familiar by elementary exposition, and their certainty tested by ordinary applications, before the violation of known analogies which some of them present will be universally acquiesced in ; and I am happy to be able to say that the large debt, which Science already owes at his hands, is likely to receive ere long this addition, and that, like a genuine lover of Truth, he will not rest content until the difficult path which he has cut for himself into her tangled and obscure recesses shall become a highway for all.

I now proceed to the consideration of Mr. Haughton's Memoir "On the Equilibrium and Motion of solid and fluid Bodies."

The object of this Memoir, as stated by the author himself, is "to deduce, by the method of the *Mecanique Analytique* of Lagrange, the laws of equilibrium and motion of elastic solid and fluid bodies from the same physical principles, and to discover by the same method the conditions at the limits." The method of Lagrange (which is so peculiarly adapted to the mechanics of a system composed of an indefinite number of acting molecules, situated indefinitely near each other), seems to have been first applied to the problem of elastic bodies by M. Navier, who determined by that method the laws of *equilibrium* of a *homogeneous* uncrystallized solid.

The late Mr. Green, of Cambridge, applied the same method to the more difficult *dynamical* question of the movement of the molecules of the *luminiferous ether;* in which application he was followed, but with more success, by the distinguished mathematician, whose name is imperishably connected with the records of this Academy.

Mr. Haughton has judiciously adopted the same mathematical method; and he has determined the form of the function which enters the general equation of Lagrange (and which depends upon the *internal forces* acting at any point of the medium), from the assumed principle, that the molecules of solid and fluid bodies act on each other *only in the direction of the line joining them*, and with forces which depend on the magnitude and direction of that line. This function is easily shown to consist of two parts, one of them depending on the first power of the displacement, and the other upon its square; the former of which is assumed to relate to *perfect fluids*, and the latter to *solids*, while both must be taken into account in *imperfect* or *viscous fluids.* The form of this function, in the case of solids, bears some analogy to, although it is quite different from, that of the function employed by Professor Mac Cullagh in his dynamical theory of light; and the author deduces, from that difference, the important physical consequence that the molecules of the luminiferous ether do not, according to that theory, act on one another in the direction of the line joining them.

The differential equations of motion cannot be integrated generally; but the values of the three component displacements which correspond to the case of *plane waves*, are manifestly particular integrals; and the equations of condition, which result from the substitution of these values in the general equations of motion, lead to a remarkable geometrical construction for the three possible *directions of molecular vibration,* and the corresponding *velocities of the plane waves*, by means of six fixed ellipsoids.

The author then determines the equation of the *surface of wave-slowness* (or the reciprocal polar of the wave-surface), the nature and properties of which are analogous to those of the surface of the same name in the theory of light. This surface is of the *sixth* degree, and has *three* sheets, corresponding to the three velocities of wave propagation ; and, like the corresponding surface in the theory of light, it serves to determine the direction of the refracted waves, in passing from one medium to another, as well as the laws of propagation in the same medium. In the most general case considered by the author,—namely, when the molecules of the medium are arranged *symmetrically round three rectangular planes*,—it is shown that this surface has *four nodes*, at which the tangent plane is a cone of the second degree; and thence arises a conical refraction in Sound, similar to that discovered theoretically by Sir William Hamilton in the case of Light.

That such analogies, and points of correspondence, should exist between the theory of light and any general theory of vibration in crystalline solids, was, of course, to be expected from the common foundation and the common postulates of the two theories. Notwithstanding this, however, the two theories diverge at a very early point. In both, indeed, the form of the characteristic function is deduced from the assumed molecular constitution of the medium. But that constitution is essentially different in the two cases,—the fundamental molecular property of the luminiferous ether, in the theory of Professor Mac Cullagh, being the unchangeableness of its density, while the corresponding basis of the theory of Mr. Haughton is the property that the molecules of the medium act on one another in the direction of the joining line.*

In conclusion, I may observe that the value of Mr. Haughton's theory—considered on its physical side, and independently of its mathematical elegance—consists in its high degree of generality ; which is such, as necessarily to embrace all the fundamental conditions of the problem, and thus to leave to future mathematicians the task only of limiting and interpreting his results.

In speaking of Dr. Hincks's philological researches I must pass over those which relate to Egyptian Hieroglyphics, and hasten to his more recent, and (at the present time) more interesting labours connected with Persepolitan writing. And in order to present an intelligible statement of the nature of these labours, and of the additions which have been thereby made to the existing amount of knowledge upon this curious subject, it will be necessary to take a hurried glance at the history of the investigation, and its principal steps.

---

* The theory of Mr. Haughton bears a much closer resemblance, in many of its results, to the wave-theory of M. Cauchy than to that of Professor Mac Cullagh, although it differs from it wholly in method. The theory of M. Cauchy is, in fact, a theory of the laws of propagated vibration in solids, and is inapplicable (as was shown by Professor Mac Cullagh) to light.

The cuneiform writing has been generally reduced to three leading divisions, which have been denominated, respectively, Persian, Median, and Babylonian. Many of the cuneiform inscriptions contain all the three kinds of writing; the first being the principal, and apparently the vernacular record, and the other two translations. They are found on rocks, slabs, and pillars, at Persepolis, at Behistun, at Ván, at Murgháb, and at Hamadán. These trilingual inscriptions are all, without exception, records of the Achæmenian dynasty; the earliest which has been discovered (the inscription at Murgháb, or Pasargadæ) relating to Cyrus the Great, and the latest to Artaxerxes Ochus.

Of the three kinds of writing found in these inscriptions, the first, or Persian, is the simplest, containing the fewest and least complicated characters. It is also distinguished from the other two by the divisions between the words, which are separated by an oblique wedge; and this circumstance, of course, greatly facilitates the task of the decipherer. The second Persepolitan writing appears to have been coeval with the first, and to have been employed only in conjunction with it, in the trilingual monuments of the Achæmenian princes; it is accordingly ascribed by the concurrent voice of philologers to the Medes, the people next in importance to the native Persians under the Achæmenian dynasty. The number of characters in this writing is far greater than in the Persian, its alphabet (or syllabary) containing about 100 letters. The third Persepolitan writing belongs to one of a group of languages (distinguished by Major Rawlinson into the *Babylonian*, the *Assyrian*, and the *Elymæan*) written in a similar character. It is ascribed, with every probability, to the Babylonians, legends in a like character being found on cylinders and bricks excavated from the foundations of the primæval cities of Shinar. It is unquestionably the most ancient of the three kinds of cuneiform writing, and was probably the type upon which the other two were constructed. The characters are more numerous and more complicated than those of the first and second kinds.

The process of resolving and interpreting an inscription in an unknown and extinct language, and written in an unknown character, appears to include three distinct and principal steps. The first of these is that of deciphering (properly so called), or determining the phonetic powers of the letters. The next step is the determination of the nature of the inflections, and the grammatical structure of the language itself, and the discovery of its congeners or representatives amongst the living languages. The third and last step consists in tracing from these sources the meaning of its roots, and thus translating the inscription.

The first of these steps was long since taken, with respect to the first Persepolitan writing. In the year 1802, Professor Grotefend, of Göttingen, examined two short trilingual inscriptions, which had been copied at Persepolis by the traveller Niebuhr, and succeeded in identifying the names of *Cyrus*, *Darius*, *Xerxes*, and *Hystaspes*, in all the three characters. The analysis of these names, in the case of the Persian, enabled him to determine the values of eleven out of the sixteen letters of which they were composed, or nearly one-third of the entire alphabet.

The next step was made by Professor Rask, of Copenhagen, in 1826. He recognised the title *Achæmenide* in the inscription of Niebuhr, and thus determined the values of two important letters, *m* and *n*, which occur in it. But the most valuable contribution made by Rask to this branch of palæography, consisted in his discovery of the resemblance of the extinct language to the Sanscrit in some of its inflections, a discovery which has been justly regarded as the key to its interpretation. Ten years later the inquiry received a fresh impulse by the simultaneous publication of two works, one by M. Burnouf, of Paris, and the other by the distinguished orientalist, Professor Lassen, of Bonn. By the analysis of a trilingual inscription, containing the names of the provinces of the Persian empire, the values of many new characters were ascertained, and the known alphabet was enlarged to twenty-six letters.

In the year 1838 the values of five new characters were added to the list,—two by Dr. Beer, of Leipsic, and three by M. Jacquet, of Paris; and the same writers discovered, independently, the fundamental principle which, strange to say, had hitherto escaped notice, that the Persian alphabet contained but three vowels, *a*, *i*, and *u*.*

But the most important of the researches connected with the first Persepolitan writing are those of Major Rawlinson. Hitherto little had been accomplished beyond the *first* step of the process,—the determination of the values of the letters. Rask, indeed, had observed the similarity of the language to the Sanscrit, and this was confirmed by Lassen and Beer, the former of whom proposed to employ the Sanscrit as a key to its interpretation; but, as yet, little had been correctly done on this head. In 1835 Major Rawlinson commenced his labours, in the country of the inscriptions; rediscovered for himself the greater part of what had been already done by European scholars; and determined the values of, at least, four new characters. But his chief work—in which he has, by one great stride, surpassed all his predecessors—is the translation of the Persian portion of the great trilingual inscription at Behistun, containing above 400 lines of cuneiform writing. This inscription had been copied, in part, by Major Rawlinson in 1837; and a large portion of the translation was made by him, and communicated to the Royal Asiatic Society, in 1839. His philological labours were suddenly interrupted in the following year, by active duty at Affghanistan; but in the autumn of 1845 he succeeded in making a correct copy of the whole of the Persian inscription (together with a considerable portion of the Median and Babylonian), and soon after completed the translation in the form in which it has been recently published. With the contents of this singular record, written more than twenty-three centuries since, and throwing an unexpected light upon one of the most controverted questions of early history, the literary public are now well acquainted.

---

* This striking similarity of the Persian to the languages of the Shemitic type, in its vocalic structure, has been recently drawn still closer by Dr. Wall, in his able Paper on the different kinds of cuneiform writing, published in the last volume of the Transactions of the Academy.

Dr. Hincks's first paper on Persepolitan writing was communicated to the Academy in June, 1846, before the publication of the first part of Major Rawlinson's memoir. In this paper he proposes three general principles respecting the orthography of the Persian, in which he corrects Lassen's account of that language. The most important of these consists in the distinction of the consonants into two classes, which he calls primary and secondary,—the former being those which may be used before the vowel *a*, expressed or supplied, the latter such as are only used before one of the other vowels. Dr. Hincks maintains, in opposition to Lassen, that these secondary consonants are phonetically equivalent to their primaries; and he lays it down, "as an invariable rule, that if a primary consonant precedes *i* or *u*, when a secondary consonant existed of the same value as the primary one, and appropriate to that vowel, an *a must* be interposed, either as a distinct syllable, or as a *guna* to the vowel." The Persian alphabet may now be considered to be completely established. Of the thirty-nine letters which compose it, Major Rawlinson and Dr. Hincks are now agreed as to the values of all but one ; Dr. Hincks having adopted three of Major Rawlinson's values, and Major Rawlinson having taken, independently, nine of those assigned by Dr. Hincks.

The data for the investigation of the Median, or second Persepolitan writing, are abundant, the trilingual inscriptions of Persepolis and Behistun furnishing more than ninety proper names, together with their Persian equivalents. Notwithstanding this, the progress made in the investigation has been comparatively small. In fact, with the exception of Grotefend, who made the first step, Westergaard is the only writer who has attempted the task of deciphering it with success. Major Rawlinson, indeed, informs us, in his Memoir on the Persian character, that he has made considerable progress in deciphering the two other kinds of Persepolitan writing; and he has given a sketch of his views on the orthography, and the general structure and affinities of the language of the second kind : but none of his results, as to the values of the characters, have been as yet published.

Westergaard held that the Median alphabet had six vowels and sixteen consonants; and that the characters represented, first, these twenty-two *letters*, and then *syllables* composed of the consonants followed by vowels. Dr. Hincks maintains, on the contrary, that there are but four vowels and five consonants; and that, besides the characters representing these nine simple sounds, there are also characters representing combinations of the five consonants with *preceding* and *following* vowels, as also combinations of the vowels with each other. Again,—while according to Westergaard the vowels are not all expressed,—according to Dr. Hincks every vowel is expressed at least once, and often more than once; it being customary to write vowels *twice over*, at the end of one character and at the beginning of the next. In accordance with this principle, Dr. Hincks adds vowels, in many cases, to Westergaard's values, thus making the characters to represent *syllables* instead of letters. Notwithstanding these important differences, however, he confirms, in general, the values given by Westergaard, although he differs from him altogether as to five of the characters, and assigns values to five more, which that writer had not valued at all.

But it is upon his labours connected with the third Persepolitan writing that Dr. Hincks's chief claim as an original discoverer must be founded. Grotefend discovered that the characters, in this writing, were partly expressive of syllables, and partly of letters; to a few of them, also, he assigned phonetic values; and he ascertained the fact of the correspondence of certain lapidary with certain cursive characters. To this little has been added by the many archæologists who have written upon the subject, beyond the mere *classification* of the characters. At an early period of his inquiries, Dr. Hincks arrived at the conclusion that the Babylonian and Assyrian writing agreed with the second Persepolitan in many of the features of the latter already noticed. The chief of the materials upon which he has since laboured are the Achæmenian inscriptions published by Westergaard, and the great inscription of the East India Company, containing 619 lines of lapidary characters. His first step in the deciphering of these documents was, of course, to analyse the proper names which occur in the third columns of the trilingual inscriptions, and to compare them with their equivalents in the other two. The values of many characters were thus determined; those of others were ascertained by comparing different modes of writing the same words in the inscriptions which commence with the same formula; and, finally, when the equivalence of two sets of characters, lapidary and cursive, was ascertained, more values were determined by comparing the proper names in the great inscription with their representatives in the other languages. By such means Dr. Hincks has constructed an alphabet, or syllabary, of the third Persepolitan writing, containing the values of ninety-five characters, together with the corresponding lapidary characters; and he has given a series of numbers from the rock inscription at Van, exhibiting the mode of expressing numerals in cuneatic characters.

Before I take leave of this subject, one more remark is necessary. It has been assumed by every writer who has hitherto engaged in the investigation of the cuneiform inscriptions, that the writing of the second and third kinds (as well as that of the first) is alphabetical. This fundamental position, however, has been recently assailed by Dr. Wall, in a very able critical paper read before the Academy; and arguments of much weight have been adduced to distinguish the principle of these two kinds of cuneiform writing from that of the first, and to prove them to be ideagraphic. It is not my duty (even if I were competent to the task) to offer any opinion upon the question thus raised. I have only to observe that what has been said above, respecting the progress recently made in deciphering these two kinds of writing, is based upon the ordinary assumption, and must be received with the reserve which necessarily attaches to a controverted position.

With Mr. O'Donovan's archæological labours I regret to say that I possess no direct acquaintance; and, accordingly, in the present notice of them, I am compelled to lean upon the friendly aid of the Secretary of the Academy, who is himself a large contributor to the same department of literature.

Mr. O'Donovan's vast acquirements connected with Irish archæology may be traced, in a great measure, to his connexion with the Ordnance Survey. In the course of the duties which this connexion imposed upon him, he visited every part of Ireland for the purpose of tracing the ancient names of places, and of collecting the local traditions connected with them, all of which he compared with the existing records in the historical manuscripts preserved in the Libraries of the Academy and the University. The object of these inquiries was to collect materials for the Historical and Antiquarian memoirs, which it was the original intention of the enlightened officers at the head of the Irish Survey to compile and publish,—an intention which (as the Academy are aware) was unhappily frustrated by the interference of Government. In the researches in which Mr. O'Donovan was thus for many years engaged, he acquired the vast amount of historical and topographical knowledge which his subsequent writings have displayed. He availed himself of the same opportunities to perfect his acquaintance with the dialects of the Irish language; and he has thus been enabled to throw a light on this department of philology, such as probably no other could have done.

The works edited by Mr. O'Donovan for the Irish Archæological Society are the first of his published labours which claim our attention. They are the following:

1. "The Circuit of Ireland, by Muircheartach Mac Neill, Prince of Aileach. A Poem written in the Year 942, by Cormacan Eigeas, Chief Poet of the North of Ireland."

2. "The Battle of Magh Rath (Moira), from an ancient Manuscript in the Library of Trinity College, Dublin."

3. "An Account of the Tribes and Customs of the District of Hy-Many, commonly called O'Kelly's Country, in the Counties of Galway and Roscommon. Edited from the Book of Lecan, in the Library of the Royal Irish Academy."

4. "An Account of the Tribes and Customs of the District of Hy-Fiachrach, in the Counties of Sligo and Mayo. Edited from the Book of Lecan, in the Library of the Royal Irish Academy, and from a copy of the Mac Firbis Manuscript in the possession of the Earl of Roden."

Mr. O'Donovan has also edited the following minor pieces in the Miscellany of the Irish Archæological Society, viz.: "An Ancient Poem attributed to St. Columbkille;" "The Irish Charters in the Book of Kells;" "A Covenant in Irish between Mageoghegan and the Fox;" and "The Annals of Ireland from A. D. 1453 to 1468 Translated from a lost Irish original, by Dudley Firbisse."

These historical tracts and bardic tales are edited, for the most part, in the original Irish, with translations and notes. In the latter Mr. O'Donovan has brought together a vast body of historical and genealogical information connected with the ancient families referred to; and he has illustrated the subjects with much curious antiquarian lore, respecting the manners and customs of the times. He has also, in many cases, annexed maps of the districts described, and topographical indexes, in which the etymology of the ancient names is given, together with the corresponding modern appellations.

Among the works of Mr. O'Donovan enumerated by the Council, in awarding him the Cunningham Medal, is his Irish Grammar. This work was undertaken for the use of the senior classes in the College of St. Columba, and was published at the expense of the Trustees of that institution. The publication has supplied a want long felt by the philologers of Europe; and the Celtic student is now in possession of a Grammar, compiled by a scholar who has studied the ancient language as it exists in our manuscript literature, and whose judgment and learning have enabled him to discriminate between the original and characteristic grammatical forms, and the accidental peculiarities belonging to particular districts or periods. The vast body of examples which Mr. O'Donovan has collected from Irish MSS., in illustration of this work, contributes greatly to enhance its value.

But Mr. O'Donovan's principal work is his edition of the Annals of the Four Masters, from the autograph manuscript in the Library of the Royal Irish Academy. The publication of this curious and important chronicle had been long and earnestly desired by Irish scholars. The language in which it is written was fast becoming obsolete, and another half century would probably have interposed a serious difficulty in its interpretation; while the curious mass of information which Mr. O'Donovan has brought together in illustration of it,—collected, as it has been, in a great part, from oral traditions,—would, in all likelihood, have been wholly lost. This work will ever remain a monument of the learning and labour of its author, and would suffice alone to place his name in a high rank in the list of Archæologists. The three large quarto volumes which have already appeared contain the Annals from A. D. 1172 to 1616; Mr. O'Donovan is now engaged in preparing for publication the earlier portion, which will be accompanied by a complete index of the names of persons and places mentioned in the Annals.

Upon the conclusion of his Address, the President presented the Medal to Sir William Hamilton, and addressed him as follows:

Sir William Hamilton,—in awarding you this Medal, the Council cannot have the gratification of feeling that they are contributing to the reputation of a name which is already known wherever Science is cultivated. But they trust that you will value it as a mark of sympathy from the Society, whose scientific character you have raised by your labours, and whose interests you have done so much in other ways to promote. Suffer me, on my own behalf, to add, that the duty which I now discharge, as the organ of the Academy on the present occasion, is to myself, personally, the most grateful of any which have devolved upon me as your successor in this Chair.

The President then presented the Medal to Mr. Haughton, addressing him as follows:

Mr. Haughton,—Accept this Medal as a testimony of the high value which the Council of the Royal Irish Academy set upon your researches, connected with a most difficult branch of Applied Mathematics; and as an expression of their hope that the labours in the application of the higher branches of analysis to physical problems, for which you have proved yourself so eminently qualified, and which have been already crowned with such success, may long continue to add to your own honour, and to that of the Academy of which you are a member.

The President, presenting the Medal to Dr. Hincks, addressed him thus:

Dr. Hincks,—Accept this Medal as a proof of the high opinion with which the Council of the Royal Irish Academy regard your researches, connected with some of the most obscure and difficult problems of Archæology. Allow me to add, that the merit of those researches, high as it is in itself, is enhanced in your case by the circumstance, that they have been pursued in the seclusion of retirement, and without any of those aids derived from the intercourse with others engaged in similar pursuits, which are usually so effective in impelling to and suggesting inquiry.

The President, presenting the Medal to Mr. O'Donovan, addressed him thus:

Mr. O'Donovan,—Accept this Medal as a testimony of the high value which the Council of the Royal Irish Academy set upon your labours connected with Irish philology, and Irish history and antiquities. This is the first occasion on which the Council, acting on the laws recently enacted by the Academy, have conferred the honour of the Cunningham Medal for works not published in the Transactions of the Academy. They therefore hope that you (and through you the literary public) will receive this award, not only as a just tribute to the value of your own researches, but also as a token of their sympathy with all who are engaged in the common pursuit of truth.

Mr. Robert Ball, Treasurer, presented an ancient silver pin of a very peculiar form, on behalf of John Mac Donnell, M. D. He also exhibited a large collection of casts of fossils, lately presented to the Museum of Trinity College by the East India Company.

The following communication on the dynamic effect of a turbine, as shown by the application of Prony's brake, was received from the Rev. T. R. Robinson, D. D.

This wheel was constructed for William Kirk, Esq., by the Messrs. Gardner, of Armagh. These gentlemen had been strongly impressed with the advantages of this wheel, by reading the account of it given by Sir Robert Kane, in the "Industrial Resources of Ireland;" and one of them actually